

Comprehensive Acoustic Analysis for Distributed Electric Propulsion Aircraft, Phase I

Completed Technology Project (2018 - 2019)



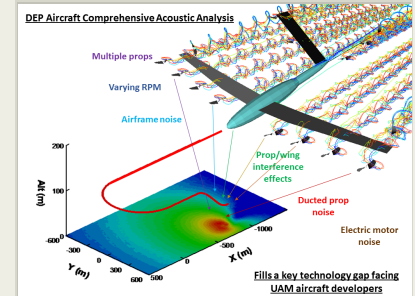
Project Introduction

A major innovative thrust in urban air mobility (UAM) is underway that will potentially transform how we travel by providing on-demand, affordable, quiet, and fast passenger-carrying operations in metropolitan areas. As cited in the NASA SBIR A1.06 topic solicitation, "Growth of UAM is dependent on affordable, low-noise VTOL configurations, which may be enabled by electric aircraft propulsion technologies." To support this, NASA implemented the DELIVER (Design Environment for Novel Vertical Lift Vehicles) program to help "... bring 100 years of aeronautics knowledge to the new entrepreneur's desktop with a design environment for emerging vertical lift vehicles." DELIVER identified a key gap in technology required by UAM vehicle developers – "no current ability to account for noise in conceptual design". The proposed effort is directed toward filling this technology gap by enhancing state-of-the-art rotary-wing aeroacoustics analysis with the key additional modeling capabilities needed for comprehensive acoustic prediction of Distributed Electric Propulsion (DEP) aircraft noise. The new tool will provide fast, accurate prediction of all the acoustic characteristics associated with DEP aircraft, including (1) noise generated by the simultaneous operation of multiple, variable RPM lifting and propelling rotors and props, (including stacked and counter-rotating blades), (2) interacting propeller/duct/airframe noise, (including strut noise and prop/wing interaction noise), (3) full-spectrum broadband noise modeling pertinent to this new class of aircraft, and (4) electric motor noise. The new software will also include auralization capabilities to enhance evaluation of community annoyance due to various acoustics characteristics beyond A-weighted sound pressure level.

Anticipated Benefits

The proposed effort directly supports NASA's ARMD's SIP strategic thrusts 3 (ultra-efficient sub/transonic aircraft) and 3B (NASA Vertical Lift Strategic Direction) by enabling accurate prediction and optimization of DEP aircraft noise characteristics and sources during the conceptual design phase. As identified by NASA, the lack of this capability is a critical gap impeding the progress of current UAM vehicle development.

CDI collaborates with many UAM vehicle developers who have an immediate need for the proposed analysis capability to predict DEP aircraft noise in the conceptual design phase. Commercialization to these customers would be concurrent with the SBIR effort. The analysis will also be of great value to the DoD and major rotorcraft manufacturers in analyzing acoustic characteristics of future compound aircraft, like the SB>1 Defiant, V-280 Valor, AVX CCH, and Aurora Lightning Strike.



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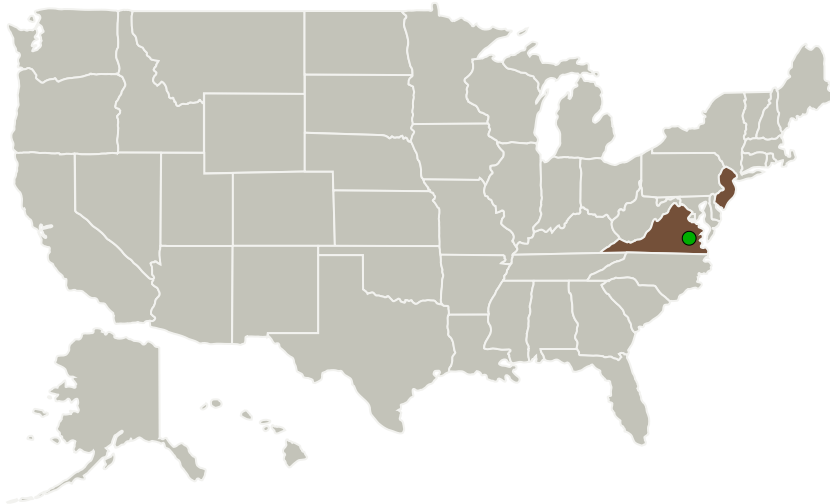
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Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
Continuum Dynamics, Inc.	Lead Organization	Industry	Ewing, New Jersey
● Langley Research Center(LaRC)	Supporting Organization	NASA Center	Hampton, Virginia

Primary U.S. Work Locations

New Jersey	Virginia
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Project Transitions

**July 2018:** Project Start**February 2019:** Closed out

Closeout Documentation:

- Final Summary Chart(<https://techport.nasa.gov/file/141316>)

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Continuum Dynamics, Inc.

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

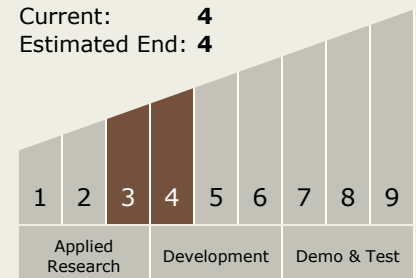
Carlos Torrez

Principal Investigator:

Daniel A Wachspress

Technology Maturity (TRL)

Start: **3**
 Current: **4**
 Estimated End: **4**

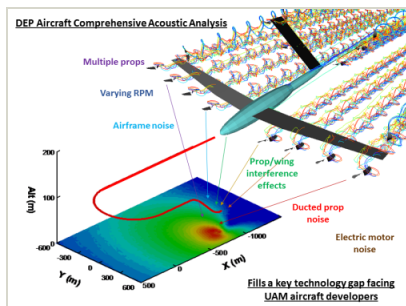


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Images



Briefing Chart Image

Comprehensive Acoustic Analysis
for Distributed Electric Propulsion
Aircraft, Phase I

(<https://techport.nasa.gov/image/125780>)

Technology Areas

Primary:

- TX15 Flight Vehicle Systems
 - └ TX15.1 Aerosciences
 - └ TX15.1.4 Aeroacoustics

Target Destination

Earth